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The Washington Department of Transportation offers the following comments on the Notice of Cooperating Technical Partners Flood Hazard Mapping Initiative [Federal Register/volume 66/ number 111/ June 8, 2001/ Notices (page 30925-309270)].

The Washington Department of Transportation is working in partnership with the Department of Ecology, FEMA, and local governments under the auspices of the Floodplain Management Task Force Created by the State legislature through ESB 3110. The major focus of the task force is to foster a statewide interagency effort to develop superior data sets for floodplain modeling for transportation project design and floodplain map updating by watershed. WSDOT funded staff at The Department of Ecology have developed a CTP with FEMA Region 10 as part of the task force's efforts. In its report to the legislature the floodplain management task force recommends the development of a statewide interagency effort to update flood maps statewide. A systematic effort to update floodplain maps has been under way for over a year in North Carolina, involving seventeen local, state, and Federal Agencies. Given the skyrocketing costs of flood damage in our state over recent years, the rapid pace of development in many of our watersheds, and the large number of major transportation projects currently being planned that may impact, or be impacted by floods, The Washington Department of Transportation feels that the time is right for the State of Washington to follow suit.

Transportation Projects and Flooding Impacts---The Problem.

Floodplains bring together several issues that pose a particular challenge to the construction and maintenance of transportation infrastructure. On the one hand, floodplains often contain sensitive wetlands, riparian zones and other biotic regions that provide critical habitat, maintain water quality, store floodwater, and provide other key environmental functions. These areas often present us with technical, regulatory, and mitigation difficulties. At the same time however, rivers with their associated floodplains are dynamic and powerful systems that can wreak havoc when human

infrastructure is placed in their path. Roads that cross floodplains are notorious for difficulty in construction, safety, repetitive damage, and maintenance.

Rivers have no budget, and need neither permits nor sleep. To make matters worse, landforms and population patterns dictate that transportation systems must often either bisect or parallel the course of rivers and floodplains, making problems regarding their interaction inevitable. The difficulties of that interaction dictate that it is in WSDOT's interest to avoid impacting floodplains whenever possible. Unfortunately, this is not always possible. The dynamic nature of floodplains also presents particular difficulties in gathering current and reliable scientific information for engineering, land use, environmental, and emergency management purposes.

In order to meet the needs posed by floodplain management and project design and permitting issues, The Washington Department of Transportation is focusing on gathering current and accurate watershed scale data that is pertinent to flood management decision making issues.

Regulatory and mapping background

Executive Order 11988, signed by President Carter in 1977 directed Federal authorities including FHWA to avoid adverse effects and incompatible development in floodplains. This is consistent with WSDOT's policy of avoiding construction in floodplains whenever possible.

Development in floodplains is regulated through locally administered development regulations, and/or Flood Hazard Management Plans and Critical Areas Ordinances, in accordance with the State Growth Management Act (GMA). Twenty-nine of the thirty-seven counties in Washington are required to carry out floodplain management planning under the GMA.

In addition, every County in Washington State with the exception of Garfield County participates in the National Flood Insurance Program (NFIP), administered by FEMA. The NFIP sets flood insurance rates based on maps of floodplains and base flood elevations. These Flood Insurance Rate Maps (FIRM's) are created for insurance purposes, however they are often put to other uses such as engineering or land use planning, as no other floodplain maps exist. The problem with this is that most of the FIRM maps are based upon data that is either outdated, not accurate, or both. FIRM maps tend to underestimate both the size of the inundation area, and the depth of the base flood. This tendency, and the accuracy problems that contribute to it need to be taken into account when using FIRM maps for transportation project planning. In addition, FIRM maps do not delineate areas of groundwater flooding; likewise, they do not capture increases in localized storm water runoff flooding that results from

development, deforestation, and other land use changes. While transportation infrastructure parallels or bisects only a portion of the watershed, (usually low in the watershed where the hydrograph is largest), Flood dynamics occur on a watershed or multi-watershed scale. Thus each of the watershed based factors attendant to flooding such as, precipitation, upslope processes, floodplain development, deforestation, floodplain constriction etc are brought to bear on Transportation infrastructure. For this reason, WSDOT must take a watershed perspective when addressing flooding concerns. However, the current FIRM maps do not reflect the impacts of basin land use changes since the maps were created. The dynamic nature of floodplains makes the fixture of permanent infrastructure such as bridges very difficult. In structure project design and implementation for structures proposed for floodplains, strong consideration must be given to the probability that the river channel will migrate within the floodplain during the life of the structure, changing floodplain dynamics and their effect on transportation infrastructure. In addition, most of the wetlands identified in Washington State are located in floodplains. Much of the designated critical habitat for the salmonid Evolutionarily Significant Units (ESU's) currently listed under the Endangered Species Act are located in floodplains as well. As such, preliminary detection of potential project difficulties associated with floodplains provides a highly beneficial approach for identifying potential environmental impacts on a watershed scale.

When construction in the floodplain cannot be avoided, then detailed study of flow and channel characteristics and floodplain hydrodynamics must be undertaken to determine upstream and downstream effects on floodplain dynamics including channel constriction and migration patterns, scour and bank erosion, inundation, a increased conveyance of downstream peak flows, backwater effects impacts on flood depth and velocities, and changes in overbank flow pathways. In addition, regulatory constraints, mitigation needs, public safety, and life-of-project maintenance and survivability issues must be addressed. The dilemma is that adequate data for this type of study is often lacking if the floodplain maps are inaccurate.

Data Quality—Data Needs

Data quality for floodplain maps is highly variable. While some floodplain maps exist for every county in Washington State, they are in many cases not well delineated, outdated, or otherwise inaccurate. It is important to note that floodplain maps are most often created for insurance purposes, a use that requires a much less rigorous level of precision when compared to engineering, environmental, or hydrological analysis. The unfortunate fact however is that the Flood Insurance Rate Maps (FIRMS) are often the only data available for floodplain delineation and are thus used for various purposes for which they were never intended.

The key drawback of these maps can be found in the data used to prepare them.

- Topography is usually limited to ten foot, or even ten-meter accuracy.
- Hydrographic data is often incomplete, and does not take into account changes in the watershed (development, filling, timber harvesting, etc that can have profound changes in the hydrograph.
- Geomorphologic data, crucial in determining channel carrying capacity, is often outdated, inaccurate, or simply nonexistent.
- Data is also lacking in key land use factors such as impervious surface, aquifer recharge and connectivity, vegetative cover and hydrographic data for ungauged tributary streams.

In addition, Flood Insurance Rate Maps (FIRM's) are prepared only for those basins where there is NFIP activity of some kind. As such, some floodplains with little or no development, especially those on smaller tributary streams are not delineated within the NFIP FIRM map program. Lastly, FIRM maps depict riverine and coastal flooding. There is no statewide database for storm water or groundwater flooding, although some local jurisdictions have developed GIS layers for these. For watersheds without mapped floodplains, and for groundwater and stormwater flooding, it is necessary to develop and utilize other GIS indicator layers.

Despite problems with the accuracy of floodplain map data, the floodplains for all areas along major rivers in the state have been mapped. This is not however true for smaller streams and larger ones that lie in unpopulated areas. Nevertheless flooding occurs in those areas giving rise to the need to develop a predictive tool for predicting flood related environmental/design problems in future projects.

We are thus left with a significant challenge in terms of predicting where potential flood impacts occur. However by utilizing new technologies such as LiDAR (Light Detection And Ranging), and other remote sensing technologies, with pre- and post processing and interpolation within a GIS format, we can develop a powerful tool set to systematically update our floodplain maps on a watershed scale.

Floodplain Mapping for Transportation Projects

Efforts along these lines is focused on enhancing the following data layers for priority basing throughout Washington State, each of which is experiencing flooding, development, and transportation impacts;

- Topography
- Hydrography
- Historic trends in Geomorphology and channel/floodplain migration
- Impervious surface

- Vegetative Cover
- Aquifer recharge areas
- Low year recurrence inundation areas

Superior data for these aspects and features is the key for developing more accurate floodplain models and maps that are needed to "plan smart" for the future, enabling the Department to design and build projects that are safer, more efficient, more durable, easier to maintain, and more environmentally sound.

There are two basic strategies to accomplishing the goal of flood protection. The first is through flood level reduction, usually through extensive flood control structures, and the second is through flood damage reduction, usually through non-structural methods (including land use ordinances, buy-outs, and elevation of existing buildings and roads). Floodplain managers have learned that the best strategies for avoiding flood damage are those that most closely approximate natural riverine processes, and focus on flood damage reduction through non-structural means, such as zoning regulations and flood-proofing existing infrastructure.

Without adequate data that allows planners to consider life-of-project changes in the watershed landscape and hydrography, we can pursue neither of these strategies well. The improvement of floodplain characterization has broad implications for transportation planning, maintenance and operation, environmental protection, land use planning, insurance, and emergency management.

As such it is a goal worth pursuing in a broad partnership with FEMA and as well as other federal, state and local agencies.

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The Department of Transportation is eager to play a prominent role in this effort.

Sincerely,

-- Signed --

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